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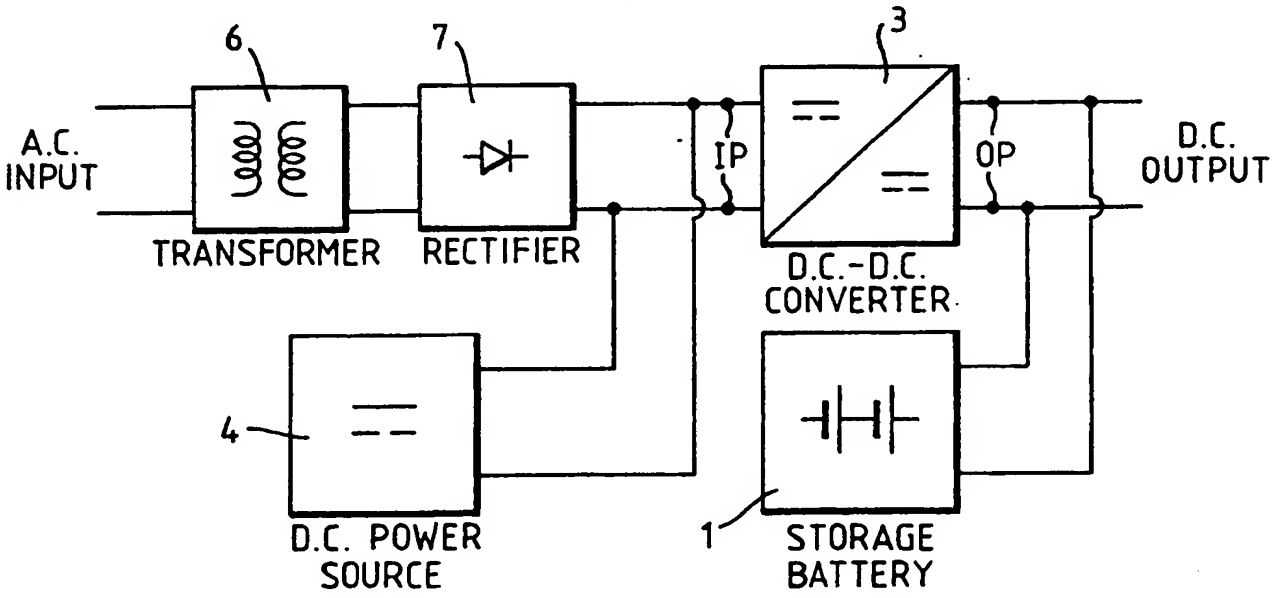
(54) Uninterruptible power supply system

(57) The power supply system includes a single DC-DC converter 3 providing a DC output. To its input it has connected two independent DC power sources 4, 6, 7. One of the sources may be a fuel cell 4, and the other derived from an AC source by way of a transformer 6 and a rectifier 7 which may be a semiconductor diode, silicon controlled rectifier, or switch mode device.

Fig. 4.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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Fig. 1.

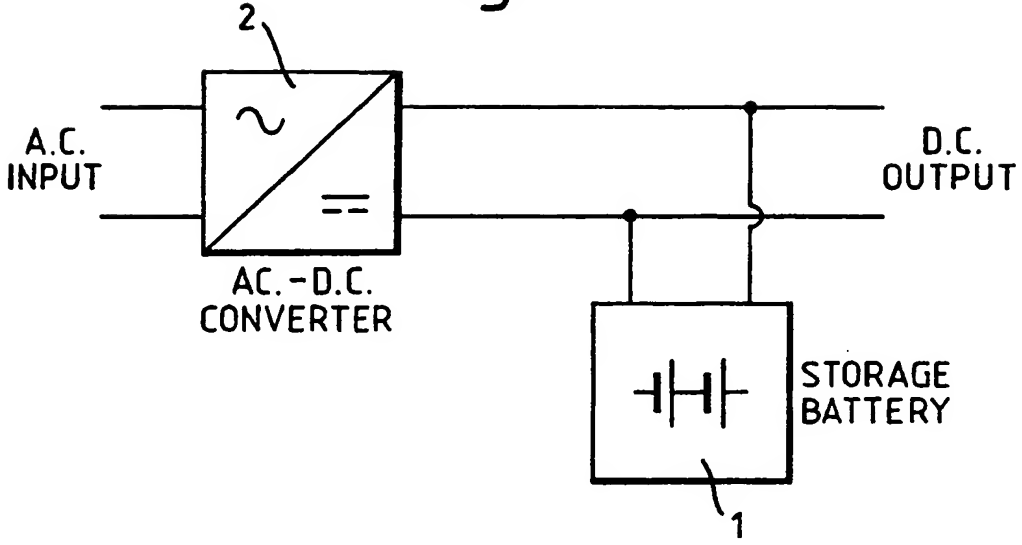


Fig. 2.

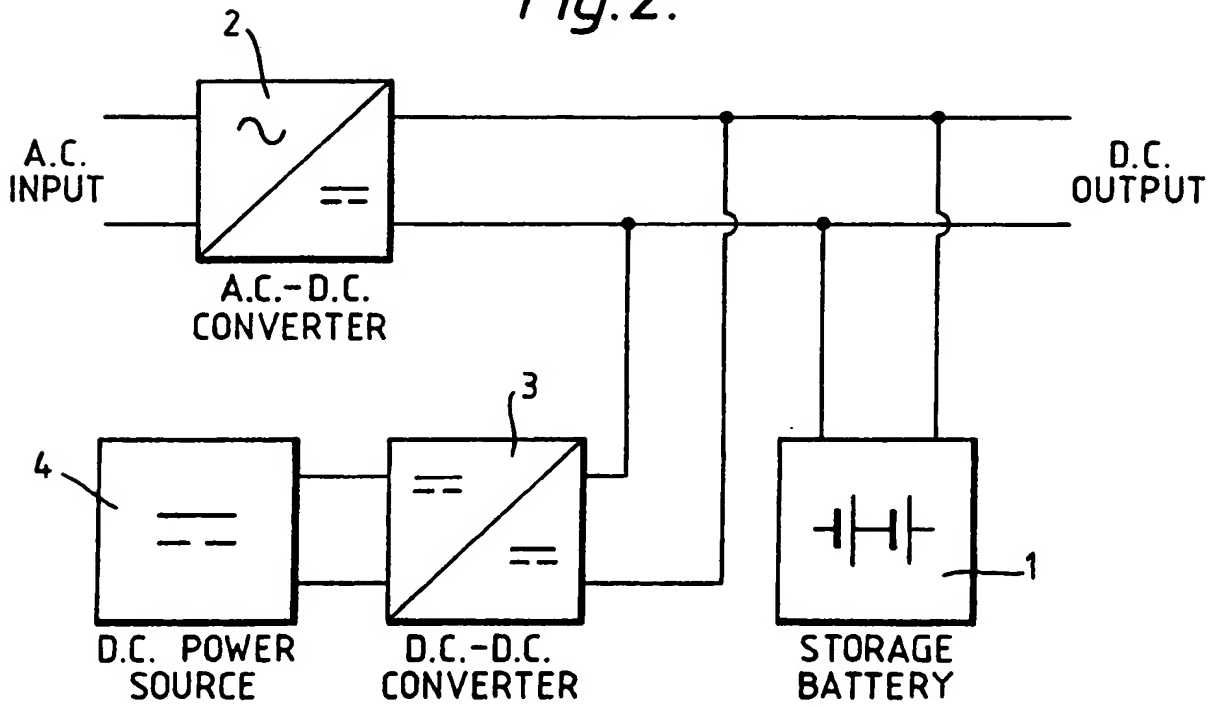


Fig. 3.

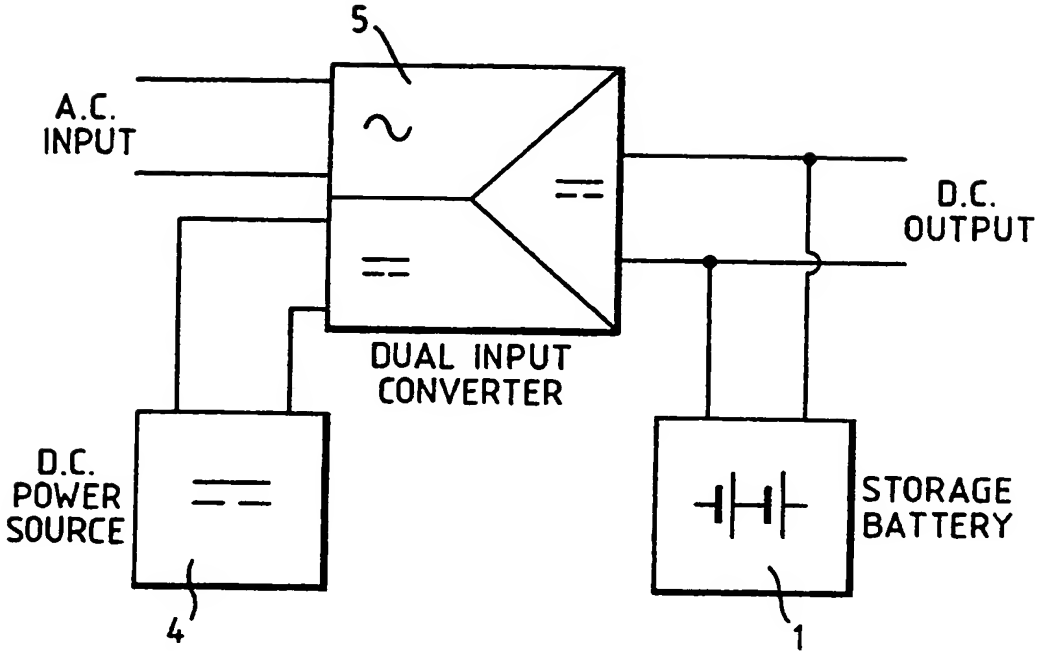
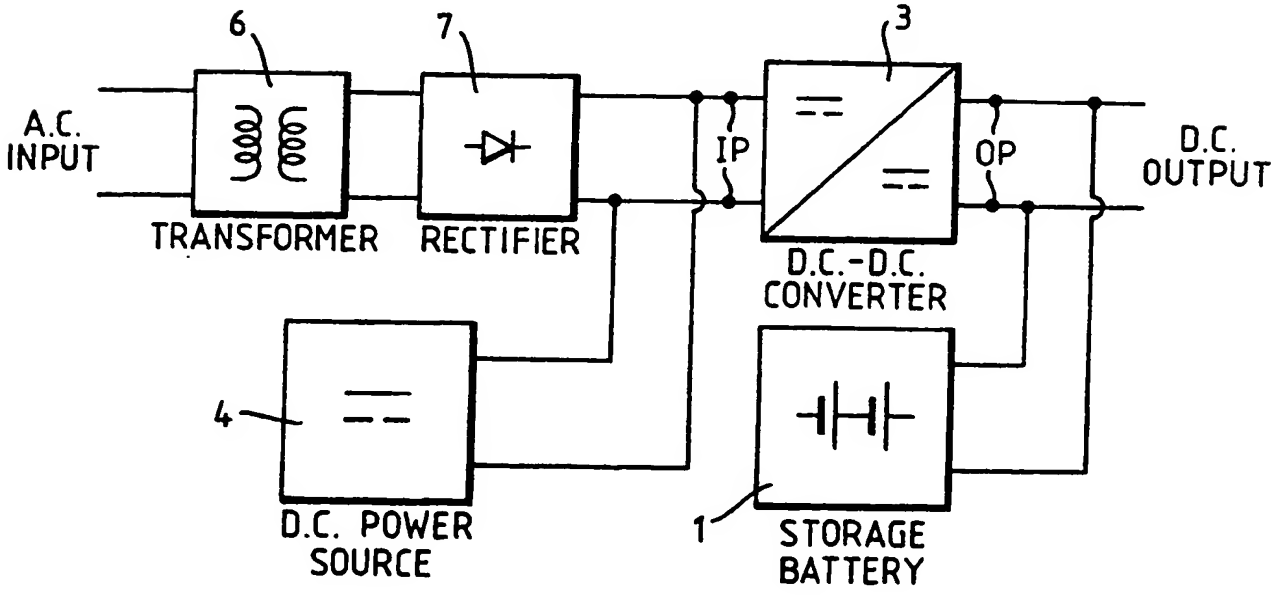


Fig. 4.



POWER SUPPLY SYSTEM

The present invention relates to a power supply, and in particular a Direct Current (DC) power supply system which may be used, for example for telecommunications equipment, and which normally derives its power from an Alternating Current (AC) supply, but which can also derive its power from a DC supply, for example a fuel cell, if the AC supply should fail. The DC output may be more stable and/or at a different voltage than the input DC supply.

In the drawings referred to hereinafter, like elements have been designated with the same reference numeral.

Electronic equipment often requires a supply of DC power. This may be derived from an AC supply by various devices and circuits such as AC-DC converters. When it is necessary to maintain the DC output when the AC source is absent for short periods, a common practice, as shown in Figure 1, is to connect batteries 1 across the DC output of the AC-DC converter 2. When it is necessary to maintain the DC output when the AC source is absent for long periods, two options are in general use; either to utilise storage batteries of high capacity or to provide an alternative source of AC power, for example a diesel generator. Where loss of DC output is undesirable, even for short periods, a small battery is included to provide power between the AC supply failing and the diesel generator starting.

The development of other products which can supply DC power for long periods, for example fuel cells, has led to further options. The output voltage of these DC power generators is not usually sufficiently stable to allow direct use by electronic equipment and

the output is conditioned to an appropriate stable voltage by a device known as a DC-DC converter. Such a DC-DC converter 3 is shown in Figure 2, connected to a source 4 of DC power. The output from the DC-DC converter 3 may then be used as an alternative to the output from the AC-DC converter shown in Figure 2. This approach includes redundancy, in that two elements, the AC-DC converter 2 and the DC-DC converter 3 provide stabilised output power, but only one is operational at any instant. A further disadvantage is that the DC-DC converter 3 is not exercised when the AC supply is present and may fail when called upon to perform, analagous to a diesel generator failing to start. This has led to the development of a single converter accepting both AC and DC inputs, known sometimes as a "Dual Input Converter" shown in Figure 3. This may take several forms but all are much more complex than either an AC-DC converter or a DC-DC converter. In Figure 3 the Dual Input Converter 5 is shown connected to a DC power source 4 by way of its DC input, and to a storage battery 1 by way of its DC output.

An aim of the present invention is to provide a power supply system which overcomes the above mentioned disadvantages in a simple manner, while offering substantial reliability.

According to the present invention there is provided a power supply system including a DC-DC converter having DC input and output terminals, and a storage battery connected to the output terminals characterised in that at least two independent DC power sources are connected to the input terminals.

According to an aspect of the present invention, one of the independent DC power sources is derived from an AC power supply.

According to a further aspect of the present invention, derivation of the DC power source from the AC power supply is accomplished by connecting a silicon controlled rectifier or semiconductor diode device to the AC power supply.

According to yet a further aspect of the present invention, the AC power source is connected to the silicon controlled rectifier or semiconductor diode by way of a transformer.

An embodiment of the present invention will now be described with reference to the accompanying drawings wherein:-

Figures 1-3 show various forms of prior art power supply systems, and,

Figure 4 shows a power supply system in accordance with the present invention.

Figures 1-3 have already been discussed with respect to the prior art and problems associated therewith.

Referring to Figure 4, a DC-DC converter is shown having input terminals IP, and output terminals OP from which a DC output can be taken. A storage battery 1 is connected across the output terminals OP.

The input terminals IP have a first DC power source 4 connected thereto, and a second DC power source 7 connected thereto. The second DC power source 7 may be connected to an AC source. The AC source may be passed through a transformer 6 before being applied to the second DC source 7.

In the preferred embodiment, the AC source is 240V AC and is applied to the transformer 6, the output of which is 24V AC. This voltage is rectified by a rectifier 7 which may be a silicon controlled

rectifier or a semiconductor diode device. The DC output from the rectifier 7 is applied to the input terminals IP of the DC-DC converter 3, which produces a stable output of 52V. The first DC power source 4 which may be a fuel cell, has its output applied to the input terminals IP of the DC-DC converter 3 to provide power during periods of AC failure. A storage battery 1 is connected to the output terminals of the DC-DC converter 3 to maintain a DC power output during changeover between the first and second DC power sources.

It will be appreciated that the functions of the transformer 6, rectifier 7, DC-DC converter 3, DC power source 4 and storage battery 1 are well known by those skilled in the art and require no further explanation.

It will readily be appreciated by those skilled in the art that alternative arrangements or improvements are possible within the spirit and scope of the present invention.

For example, the DC-DC converter may be of the type which in addition to controlling the output, may also control the way power is taken at the input, enabling the load on the fuel cell to be controlled and the AC derived power to have substantially a unity power factor. The use of a transformer provides sufficient safety isolation, and therefore the DC-DC converter can be of a simple, non-isolated topology.

Furthermore, switch mode techniques could be employed in the rectification of the AC supply.

CLAIMS:-

1. A power supply system including a DC-DC converter having DC input and output terminals, and a storage battery connected to the output terminals, characterised in that at least two independent DC power sources are connected to the input terminals.

2. A power supply system as claimed in Claim 1, wherein one of the independent DC power sources is derived from an AC power supply.

3. A power supply system as claimed in Claim 2, wherein the DC power source is derived by connection of a silicon controlled rectifier to the AC power supply.

4. A power supply system as claimed in Claim 2, wherein the DC power source is derived by connection of a semiconductor diode device to the AC power supply.

5. A power supply system as claimed in Claim 3 or 4, wherein the silicon controlled rectifier or semiconductor diode device is connected to the AC power source by way of a transformer.

6. A power supply system substantially as hereinbefore described.

7. A power supply system substantially as hereinbefore described with reference to Figure 4 of the accompanying drawings.

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